Corrective Action Plan
For the
Lawrence Berkeley National Laboratory
Integrated Safety Management Peer Review

June 1, 2006

Executive Summary

In December 2005, Director Steven Chu initiated an external peer review of Integrated Safety Management (ISM) implementation at LBNL in response to a series of leading indicators of deteriorating Environment, Safety, and Health (ES&H) performance. The review was commissioned by the University of California, and was performed by a national panel of recognized ES&H experts who conducted a four day review, observed by DOE safety specialists and managers. The panel made 54 suggestions related to 24 identified ES&H issues. A number of management areas for improvement were identified, including the effectiveness of principal investigators, middle managers, and first line supervisors as safety leaders and mentors.

This Corrective Action Plan (CAP) was prepared by a CAP Development Team in close coordination with Laboratory and UC management. From analysis of issues and findings of the Peer Review and other assessments and incidents, the Team identified a number of root causes. These causes were systematically analyzed and grouped into five categories: (1) Inadequate line management ES&H execution; (2) Insufficient ES&H assurance mechanisms, (3) Lack of uniform education and training for supervisors and coordinators, (4) Insufficiencies in proactive posture on ES&H, and (5) Inadequate Lab-wide work control.

The CAP was prepared through an analysis of performance deficiencies and is designed to improve overall ES&H performance by addressing the organizational, cultural, and implementation issues raised by the Peer Review. Ninety-seven actions are assigned to managers in the following areas to collectively address systemic ES&H issues:

- *Strengthened Line Management Execution*. 12 actions address clearly defined ES&H roles and responsibilities for line managers, including performance and training.
- *Robust ES&H Assurance Mechanisms*. 26 actions are directed at re-establishing ES&H technical program assurance and division self-assessments.
- *Educated Managers, Supervisors, and Coordinators*. 19 actions will help ensure that ES&H training will be based on formalized requirements, including enhanced mentoring of students & post docs.
- *Proactive Posture on ES&H*: 11 actions are aimed at ensuring that better ISM plans will be developed based on well understood risk behavior, job hazards, and improved controls and communications.
- *Strengthened Lab-wide Work Control*. 29 actions address improved hazard documentation, work authorizations, and oversight of employees, sub-contractors, and vendors.

Of the 97 identified corrective actions, 32 are underway, with 7 either complete or substantially complete. The remaining actions are scheduled to be completed by October 31, 2007. Progress on implementation of the CAP will be a key agenda item in the quarterly performance reviews that are conducted with DOE, LBNL, and the University of California. The LBNL Corrective Action Tracking System (CATS) will track status and closure of all actions. The DOE-BSO Manager, LBNL Director, and UC Vice President for Laboratory

Management will appoint a change control board responsible for reviewing proposed changes that would materially alter the schedule or approach proposed in the CAP.

Introduction

In December 2005, Director Steven Chu initiated an external peer review of the implementation of Integrated Safety Management (ISM) at LBNL in response to a series of leading indicators of deteriorating Environment, Safety, and Health (ES&H) performance. The review was commissioned by the University of California in January 2006, and was performed by a national panel of recognized ES&H experts who conducted a four day review, observed by DOE safety specialists and managers. The Lawrence Berkeley National Laboratory Integrated Safety Management Peer Review Report, completed on February 10, 2006 (Appendix 1) transmits the Peer Review Committee's findings and suggestions. This ISM Peer Review Corrective Action Plan (CAP) responds to the findings and suggestions in that report.

A 20 member CAP Development Team (Appendix 2) was established by Laboratory leadership that included staff from a wide cross-section of the Laboratory scientific and operations divisions. The Team included extensive participation by line organizations as well as ES&H Division staff. Many Team members were involved in the investigations and assessments that occurred prior to the Peer Review and that were reviewed as part of developing this CAP. Thus, the team was able to leverage the knowledge gained from their participation in the previous investigations and assessments to better understand the findings in the Peer Review and conduct root cause analysis. A CAP Working Group was drawn from the CAP Development Team to manage the process of developing the CAP. Two Root Cause Analysis sub-teams were drawn from the CAP Development Team to conduct root cause analysis of the Peer Review findings and the results of the analysis of previous investigations and assessments. The Team identified, with Laboratory leadership concurrence, the managers responsible for carrying out the corrective actions.

The goals of the CAP development process were to: (1) Evaluate the Peer Review findings in light of previous findings, (2) Integrate and condense the information in a rigorous and formal manner, (3) Identify the common themes with institutional impact, (4) Identify latent management issues as potential underlying causes of less than adequate performance in specific programmatic, technical, and management areas, and (5) Identify a set of corrective actions to address these issues.

Process Used in Developing the CAP

To successfully pursue the goals of the CAP, the CAP Team and Laboratory leadership developed a rigorous three-step integrated process, with some degree of iteration for refinement and improvements. In this manner the Corrective Actions would be targeted to both the Peer Review findings and leverage other salient EH&S investigations. This would also assure that the CAP findings and actions were sufficiently broad to address the breadth of ES&H issues and the underlying root causes. The process would also be structured to allow the development of a Work Breakdown Structure, effective management assignments, and the tracking of progress and implementation. The three steps, conducted in a generally sequential approach, were comprised of a (1) Backlook Review (2) Root Cause Analysis, and (3) Corrective Action Development. The CAP Team activities began in February following the receipt of the Peer Review report, and concluded at the end of May 2006. Some actions were activities that were already being planned, and were incorporated into the CAP and some were initiated in the initial months of CAP development.

Backlook Review

An important step in achieving the CAP goals was to look at studies prior to the Peer Review; to reassess earlier investigations in light of the Peer Review and as additional data for use in analyzing root causes. This enabled a determination of whether deficiencies were isolated or represented systemic program-related or cross cutting issues. To achieve this objective, the CAP Working Group reviewed the following reports that had been generated from analyses conducted in 2003, 2005 and 2006:

- Lawrence Berkeley National Laboratory Building 58 Electrical Safety Event of June 2, 2005 (June 23, 2005)
- LBNL Electrical Safety Self-Assessment (April 8, 2005)
- Causal Analysis of 15 Electrical Incidents that Occurred at Berkeley Lab from July 2002 to June 2005 (August 31 2006)
- Laser Safety Program Review Panel Report (July 28, 2003)
- Berkeley Lab FY05 50 OSHA Recordable Cases Root Causes and Lessons (January 9, 2006)
- Crane, Hoist, Rigging & Forklift Safety Program at the Lawrence Berkeley National Laboratory (October 13, 2005)
- Report of the RSC Sub-committee to Investigate and Review ALS Shielding Control Procedures (January 18, 2006)

The issues were identified and tabulated in the Backlook List, and those from the Peer Review were sorted using the Occurrence Reporting Causal Analysis Tree (CAT). Common themes emerged, some of which indicated broad extent of condition and a few with latent management implications. The CAT categories with the highest number of common themes are "management methods" and "work organization and planning."

The information developed from the initial analysis was presented to the CAP Development Team for discussion, elaboration, and vetting in an open forum. Potential extent of condition issues and latent management issues were identified. All issues were recorded by a facilitator and discussed and clarified as they were recorded. Two separate meetings were devoted to this process with sufficient time in between to allow the group members to discuss the information with co-workers, managers, and staff. Care was taken to ensure that the issues raised by BSO Response to Commitments 23 and 25 were included. Using the Peer Review as a framework (i.e., the 7 principles of ISM), the CAP Working Group sorted and incorporated all the issues from these meetings into the Issues section of the Peer Review Report. No information was deleted or modified and overlapping issues were not combined. This resulting document is entitled Issues (PR/Backlook), 3/24/06 (Appendix 3).

Root Cause Analysis

Two teams of individuals with TapRoot training subjected the Issues (PR/Backlook) to root cause analysis using proactive analysis approach designed to address programmatic and systemic weaknesses in implementation of ISM. The goal at this stage was to identify a list of root causes that addressed, in a proactive manner, all the issues gathered in the Backlook Review and the Peer Review. Each root cause was characterized with a narrative that described the contributing factors and nature of the deficiency. This task was completed on April 25, 2006 and the results presented as Peer Review/Backlook Issues: Root Cause Analysis (Appendix 4). (The Principles of ISM are used as the framework for listing the identified set of root causes and conditions.)

In order to facilitate development of corrective actions, the root causes from the Peer Review/Backlook Issues: Root Cause Analysis (Appendix 4) were grouped into five categories (Appendix 5):

1. Line management execution of ES&H
2. ES&H assurance mechanisms
3. Educating managers, supervisors, and coordinators
4. Proactive posture on ES&H
5. Lab-wide work control program

Corrective Action Development

Sub-teams were assigned to each category and corrective actions were developed for the root causes in these categories (Appendix 6). The analysis identified 97 actions that would be needed in order to correct the deficiencies identified in the root cause analysis. Typically several actions were needed to address each root cause/deficiency, and in many cases, a corrective action was applicable to more than one root cause. The appended schedules provide a cross-reference to the first root cause where it applies. Each corrective action has a unique number that can be traced back to the Peer Review/Backlook Issues: Root Cause Analysis (Appendix 4) and to the Peer Review Report (Appendix 1). For instance, Corrective Action 1.1.1.01 relates to Root Cause 1.1.1, which in turn relates to Peer Review Report Issue 1.1. Several of the actions had been identified prior to the completion of the Peer Review and were incorporated as a part of the CAP. Each Corrective Action is clearly stated in the Appendices and can be verified and validated when complete. Each corrective action has an assigned responsible manager and scheduled date for timely completion. As many of the Corrective Actions are interdependent and sequential, they are displayed with defined task dependencies in the Corrective Action Plan Schedule (Appendix 6). Interim corrective actions are also indicated in the section below.

In addition to aligning corrective actions for the Root Cause groups, this CAP also reports on actions specifically targeted to Laser Safety and the Advanced Light Source, as those areas were also included in the Backlook Review that contributed to the Root Cause Analysis.

Corrective Action Program

Berkeley Lab has developed a formally scheduled program to effectively and efficiently implement the 97 actions. As noted above, the corrective actions are organized in five categories. The summary below identifies the number of actions associated with each Root Cause Category and provides a summary of those actions. (Appendix 6). To facilitate review and understanding, Appendix 7 arrays the corrective actions according to ISM Principles and Appendix 8 lists only those root causes with corrective actions by Corrective Action Category.

Strengthened Line Management Execution of ES&H

Twelve actions support Strengthened Line Management Execution to address the need for clearly defined ES&H roles and responsibilities for line managers, including performance and training. A critical step in addressing many of the root causes is more clearly defining line management with regards to ES&H and establishing this in the Laboratory's governing documents. These steps are necessary precursors to refining performance review criteria, re-defining training requirements, and revising training. The steps include changes to the Regulations and Procedures Manual, Pub 3000, Division ISM plans, and Safety Committee Review Criteria.

Robust ES&H Assurance Mechanisms

Twenty six actions are directed at establishing more robust ES&H assurance mechanisms, including re-establishing ES&H technical program assurance capabilities and refining key elements of the ES&H assurance system. This includes refining division self-assessments based on revised line management roles and responsibilities and other drivers. Criteria for the Integrated Functional Appraisals (IFA) and Management of ES&H (MESH) reviews were revised for FY06 and the effectiveness of these changes will be reviewed as part of the CAP. As part of LBNL's effort to expand collaboration with UCB, the existing partnership agreement regarding ES&H matters will be reviewed and revised.

Educating Managers, Supervisors, and Coordinators

Nineteen actions will help ensure that Managers, Supervisors, and Coordinators are appropriately trained in ES&H policies and practices, and training will be based on formalized requirements, including requirements for enhanced mentoring of students and post docs. Corrective actions in this area are directly related to Strengthened Line Management in that any revisions of training requirements and training courses is dependent on the definition of line manager and the attendant roles and responsibilities. The Safety Coordinator plays a critical role in how these roles and responsibilities are carried out. Corrective actions are planned to determine and formalize minimum qualifications and training requirements for this group. There will also be a focus on enhancing mentoring and ES&H awareness of post-docs and graduate students. Part of educating line managers regarding ES&H will be a coordinated communications strategy focused on quality of work and concern for ES&H.

Proactive Posture on ES&H

Eleven actions are aimed to ensure a far more proactive approach to ES&H planning and implementation so that ISM plans can be developed based on more well understood risk behavior, job hazards, and improved controls, and communications. A key element to taking a more proactive posture is looking at what is being communicated about safety and developing and implementing a communications strategy that is fully credible and consistent. This section also focuses on understanding risk-taking behavior at the Laboratory and developing strategies and messages that will guide Laboratory staff in making better choices regarding job hazards analysis and establishing controls. These corrective actions are intended to address the fear-of-reporting issue through better understanding of what messages are being transmitted and changing those messages in a systematic manner.

Strengthened Lab-wide Work Controls

Twenty nine actions address strengthened Lab-wide Work Controls, including improved hazard documentation, work authorizations, and oversight of employees, sub-contractors, and vendors. The actions focus on improving the work control program Lab-wide including EH&S approved authorizations, line management authorizations and project/maintenance work. This includes completing the transition of Activity Hazard Documents (AHDs) into an online electronic format, reviewing the effectiveness of the revised system and developing routine methods of ensuring implementation of AHDs. An approach to more formality in line management authorizations will be developed. Hazard identification and oversight policies and procedures for work performed by the Facilities Division, construction sub-contractors, and equipment vendors will be reviewed and revised.

Laser Safety

The EH&S Division developed a corrective action plan to address deficiencies identified during inspections of laser labs in November and December 2005 (Appendix 12). Although

significant progress has been made, the conduct of comprehensive reviews of all Class 3B and 4 laser labs is behind schedule. This activity was scheduled to be completed by April 30, 2006. However, the departure of the former Laser Safety Officer, the need to provide real time customer support (e.g., eyewear selection, AHD review, interlock safety, etc.), and the need to develop/improve our infrastructure (AHD database, laser inventory, inspection procedures, and documentation) caused the Laboratory to delay this effort. This activity is now anticipated to begin in June/July 2006 (supported by the new Laser Safety Officer) and conclude by September 30, 2006.

The effort will include:

- Conducting and documenting laser safety inspections
- Reviewing activity hazard documents (AHDs)
- Reviewing completeness of the laser inventory
- Checking laser protective eyewear
- Testing interlock systems

In the interim, BSO requested assurance that laser safety requirements are in place and the Laboratory is providing this assurance.

Advanced Light Source (ALS)

The ALS is making good progress on corrective actions relative to the Radiation Safety Committee's review of shielding at the ALS and the related Price-Anderson Amendments Act (PAAA) Noncompliance Tracking System (NTS) report (Appendix 13). Review and tracking of corrective action implementation continues to be carried out by the Committee. Five corrective actions are now underway:

- Demonstrate technical knowledge, skills, and commitment for safety-critical staff
- Implement effective line management changes and appropriate staffing levels
- Implement priority radiation protection recommendations
- Complete implementation plan for lower priority recommendations
- Complete review and approvals of shielding control and compliance program

Completion of these actions is planned by September 29, 2006

Supplement to LBNL Response to DNFSB Recommendation 2004-1 Implementation Plan Commitments 23 and 25

On February 1, 2006, LBNL provided its initial response to Commitments 23 and 25 of the Defense Nuclear Facilities Safety Board Recommendation 2004-1 Implementation Plan (Appendix 14). This response described our current systems for work planning and control and for feedback and improvement. It also identified a few areas for improvement and referred to the Peer Review as a source for other opportunities for improvement. The corrective actions for Corrective Action Category 2, Feedback and Improvement, and Corrective Action Category 5, Work Control, are directly applicable to Commitments 23 and 25, and serves to supplement our response of February 1, 2006.

Interim Actions Taken to Address Peer Review Issues

The Laboratory has taken a number of interim actions to promptly address the issues raised by the Peer Review in advance of completing this CAP. In fact, some had been initiated before the Peer Review occurred. Descriptions of these actions are included in the weekly CAP status reports that have been provided to DOE since early March, 2006.

Some of these actions are still in the process of being implemented and are directly pertinent to the root causes cited in the root cause analysis. These are included as on-going corrective actions in this CAP:

- Corrective Action 3.3.1.01 through 3.3.1.04 : Improving incident investigation process and root cause analysis capability
- Corrective Action 3.1.2.01: Determine and formalize roles and responsibilities of Safety Coordinators
- Corrective Action 6.3.1.02: Development and delivery of safety walkaround training (Appendix 9)

Interim actions completed include:

- Corrective Action 2.1.2.07: Revision of IFA and MESH protocols for FY06 (Appendix 10)
- Corrective Action 5.1.3.01 IFA Protocol revised to focus on formally authorized work
- Corrective Action 7.1.3.02: Development of the Corrective Action Tracking System (Appendix 11)
- Initiation of a benchmarking relationship with Intel Corporation in March, 2006
- Hiring of key EH&S personnel including an electrical safety officer, a laser safety officer and a health physicist

A number of Divisions have also taken additional actions to enhance safety performance:

- Physics – Revision of safety roles and responsibilities for supervisors and permanent scientific staff, trained managers, and supervisors
- Computing Sciences – Verifying that managers and PI's are accepting responsibility for effective ISM implementation through conduct of safety specific all-hands meetings, integrating safety into regular staff meetings, and including safety articles and tips in weekly electronic newsletter
- Engineering – Enhanced training of managers and supervisors regarding line management responsibility for safety and cascading of roles and responsibilities
- Material Sciences – Customizing EH&S training for all managers and supervisors based on the institutionally developed course

Thus, of the 97 identified corrective actions, 32 are already underway, with 7 either complete or almost complete. The remaining actions are scheduled to be complete by October 31, 2007.

Management Approval and Support

Laboratory Director Steven Chu initiated the Peer Review, participated in its conduct, and guided the development of the CAP with Chief Operating Officer David McGraw and Acting ES&H Division Director Howard Hatayama. Director Chu has authorized the resources for timely implementation of the CAP and is responsible for overseeing closure of 20 of the actions that involve overall laboratory policy, line management authority, and roles and responsibilities. He has delegated the authority and deployment of resources for specific activities contained in the plan to the Chief Operating Officer and to the Laboratory's scientific and operations line organizations. The Director of the EH&S Division coordinates the implementation of the Plan and provides progress reports.

Process for Tracking Implementation of CAP

Progress on implementation of the CAP will be included as a routine agenda item in the quarterly performance reviews that are conducted between DOE, LBNL, and the University of California. LBNL will use its institutional Corrective Action Tracking System (CATS) as the mechanism for tracking implementation and closure of the corrective actions in this CAP. The University will specifically employ the UC/LBNL Contract Assurance Council to review the status of ES&H performance progress and the CAP implementation.

CAP Change Control Process

A Change Control Board will be convened consisting of representatives of DOE-BSO, LBNL, and the University of California. Members of this board will be appointed by the DOE-BSO Manager, LBNL Director, and UC Vice President for Laboratory Management. The Board will be responsible for reviewing proposed changes that would materially alter a corrective action approach or cause a delay of more than a month to its schedule. The Board will make a recommendation to the DOE-BSO Site Manager who is responsible for approving the proposed change. Changes that do not rise to the threshold for review by this Board, will be reviewed and approved by the LBNL EH&S Division Director.

Follow-up CAP Effectiveness Review Process and Validation

Completion of corrective actions will be validated by LBNL Office of Contract Assurance. Effectiveness review of the corrective actions will be integrated with the UC Assurance Plan for Lawrence Berkeley National Laboratory (Appendix 15).

Appendices

1. LBNL ISM Peer Review Report (February 10, 2006)
2. CAP Development Team Roster (June 1, 2006)
3. Issues (Peer Review + Backlook) (March 24, 2006)
4. Peer Review/Backlook Issues Root Cause Analysis (April 26, 2006)
5. Actionable Items for Corrective Action (May 4, 2006)
6. 2006 ISM Peer Review Corrective Action Plan Schedule (June 1, 2006) (By Corrective Action Categories)
7. 2006 ISM Peer Review Corrective Action Plan Schedule (June 1, 2006) (By Principles of ISM)
8. 2006 ISM Peer Review Corrective Action Plan Schedule (June 1, 2006) (By Active Root Causes)
9. Line Management Walk-around Training Course Syllabus
10. Revised IFA and MESH protocols
11. Corrective Action Tracking System description
12. Status of Laser Safety corrective actions
13. Status of ALS corrective actions
14. Memo from Howard Hatayama to Aundra Richards Subject: Response to Commitments 23 & 25 (February 1, 2006)
15. UC Assurance Plan for Lawrence Berkeley National Laboratory (October 2005)